Chapter 10
PETROLEUM PIPELINES AND STORAGE FACILITIES

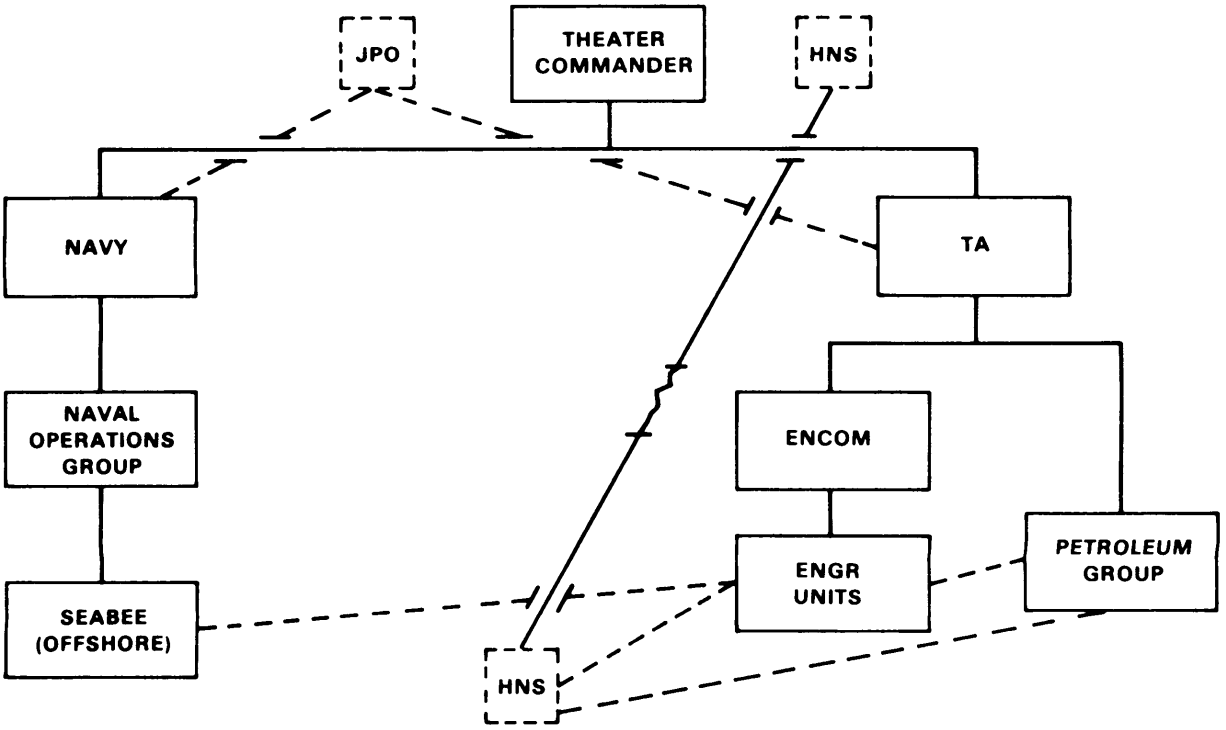
The AirLand battlefield is a highly mechanized and mobile environment, increasingly dependent on petroleum products, In the European Theater during World War II, about half the total logistical tonnage was petroleum fuels. During the Korean War and in the war in Vietnam, this figure rose to about 60 percent. The concept of mobile warfare on the deep battlefield of future conflicts anticipates increased consumption of these products,

In the conceptual plan for supplying needed fuels. hulk petroleum is delivered through ports or LOTS. There, it is off-loaded into storage facilities and sbipped forward. The modes of shipment in descending order of priority are pipeline, inland waterways, rail, motor carriers, and aircraft. The preferred method of shipment to the corps area is by pipeline. The use of pipelines reduces the amount of traffic on other modes of transportation. Pipelines save more energy and personnel costs than other methods of operation. The Engineer mission is to provide genera] and specialized assistance in building and maintaining pipeline systems.

RESPONSIBILITIES

The Joint Petroleum Office (JPO) coordinates the petroleum needs of all services within the Theater command. The petroleum group commander for the Theater Army (TA) is responsible for all aspects of theater level petroleum distributio planning and related supply opeations. The group performs liaison with the Theater Army Materiel Management Center (TAMMC) and Host Nation (HN) staffs for coordinating allied petroleum distribution support. It distributes fuels based on priorities established by the TA commander and by directives received from the TAMMC.

Bulk petroleum in the Theather of Operations is distributed by the Petroleum Pipeline and Terminal Operating Battalions. These battalions are responsible for the operation and organizational maintenance of petroleum peipelines and storage facilities. They are responsible for installing collapsible tanks



ENGINEER SUPPORT TO POL FACILITIES CONSTRUCTION

and associated equipment for the Tactical Petroleum Terminal (TPT). They also install collapsible hoselines used to temporarily extend pipelines.

The Theater Army Engineer Command (ENCOM) or the senior engineer HQ supports the petroleum distribution effort. The ENCOM provides maintenance (excluding organizational maintenance) and repair of existing pipelines. It also designs, constructs, and expands the tactical pipeline system (including marine terminals and storage facilities). These tasks are done by US engineer forces or through coordination with the HN.

ENGINEER CAPABILITIES

Engineer support to the petroleum distribution effort calls for a combination of general and special construction skills. To maximize potential and minimize duplication of low density skills and equipment, general engineer construction units are augmented with specialized units from the active or reserve establishments.

COMBAT HEAVY ENGINEER BATTALIONS (TOE 5-115)

The primary military engineer units required to support the petroleum distribution effort are the Combat Heavy Engineer Battalions. These units provide horizontal and general construction support for most of the tactical pipeline construction mission.

Many tasks in pipeline construction are horizontal. These include route clearing and flattening, and constructing gap crossings and pipe supports. These tasks can best be done by a general construction unit with heavy earthmoving equipment. The battalions also provide the labor or help to supervise HN personnel for assembling pipe and associated equipment.

ENGINEER PIPELINE CONSTRUCTION SUPPORT COMPANIES (TOE 5-177)

These units provide technical personnel and specialized equipment. They help construction and combat engineer battalions to construct, rehabilitate, and maintain pipeline systems. (They do not perform organizational maintenance.) These units have a limited independent capability to construct, rehabilitate, and maintain pipeline systems.

Pipeline Construction Support Companies can help using units with specialized repairs. They can provide advisory personnel to three engineer companies of an engineer battalion engaged in pipeline construction. Unit personnel can advise on such tasks as pipe stringing, pipe coupling, storage tank erection, and pump station and dispensing facility construction. Engineer Pipeline Construction Support Companies are equipped to function on a two-shift basis. The companies have a limited number of bolster trailers for transporting pipe.

ENGINEER PORT CONSTRUCTION COMPANIES (TOE 5-129)

In support of the petroleum distribution effort, Port Construction Companies install offshore mooring facilities. They can install both floating and underwater pipeline. They also construct POL jetties and wharfs, and can install limited POL storage facilities in the beach area. With the support of divers, these units can conduct underwater pipeline repairs.

PIPELINE DESIGN TEAMS (TOE 5-530HD)

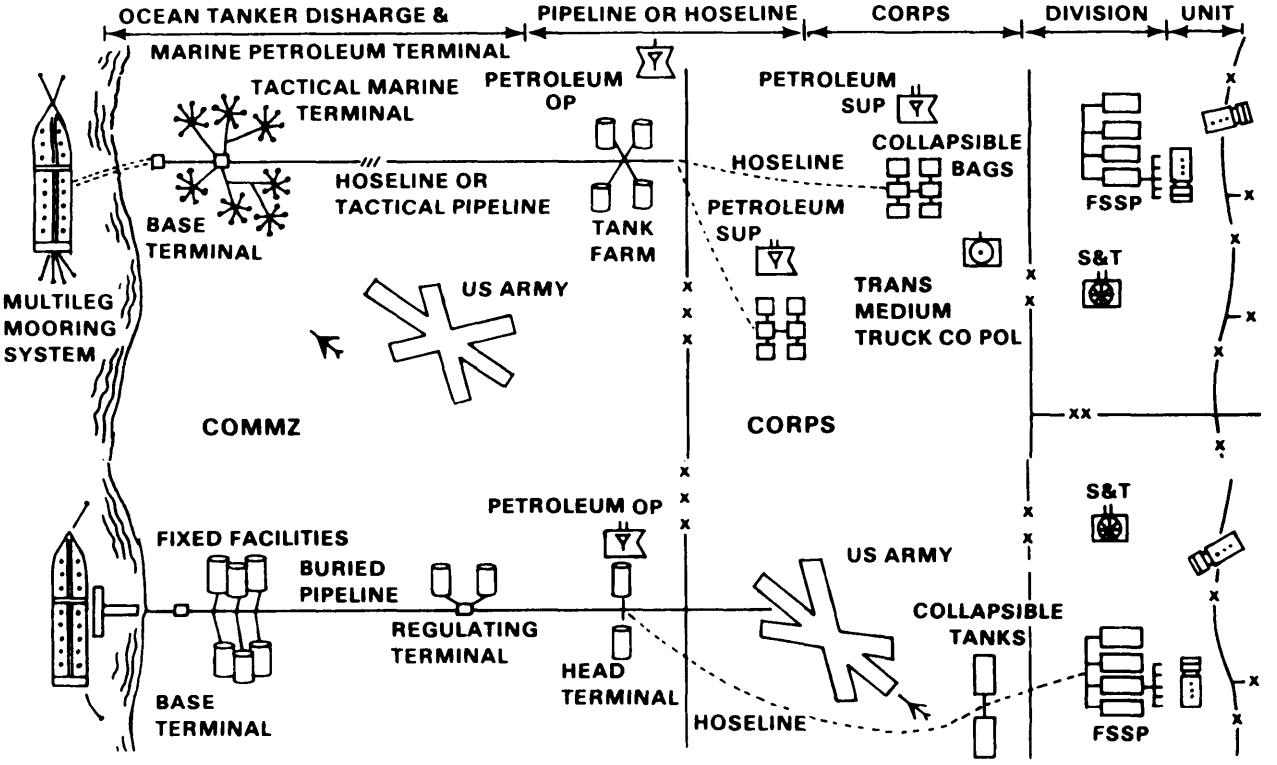
This six-member team helps to design specialized pipeline construction projects. It can select major tank farm locations and pipeline routes, and design related structures. These include offshore discharge and loading facilities and fixed dispensing equipment. This team helps to manage and supervise construction operations. One such team is allocated per engineer group or brigade engaged in pipeline construction operations.

RADIOGRAPHIC WELD INSPECTION TEAMS (TOE 5-530HJ)

This three-member team performs radiographic inspection of pipeline welds for the unit to which it is attached or assigned. One team should be allocated for each Engineer Port Construction Company (TOE 5-129). One team should be assigned to each Engineer Pipeline Construction Support Company engaged in welded pipeline construction.

MILITARY BULK PETROLEUM DISTRIBUTION SYSTEMS

The Army has used large scale petroleum pipeline distribution systems since World War II. During the war and shortly afterward, the total military pipeline system became standardized. Standardization included the bulk fuel distribution equipment. This equipment remained largely unchanged until the mid-1980s, when a major upgrade of materials and equipment took place. The entire distribution system is now subdivided into offshore and inland systems. The basic characteristics of each system and some of their salient features are described in the following paragraphs.



BULK PETROLEUM DISTRIBUTION SYSTEM

OFFSHORE PETROLEUM DISTRIBUTION SYSTEMS (OPDS)

The OPDS is a set of equipment and material used to move petroleum from ships or barges to the first storage facilities on land. The OPDS maybe installed entirely by US Army engineer units or in conjunction with US Navy construction units. This depends upon the specific theater or situation. The Army engineers and Navy construction forces have the capability to extend underwater pipeline up to 4 miles from the high water mark. Such lines are needed where shallow waters or blocked channels prevent tankers from entering ports. If tankers can enter and use existing port facilities, engineers install fuel unloading equipment at the pier or wharf. The first major storage facility is usually located within a 5-mile radius of the beach.

TACTICAL PETROLEUM TERMINALS (TPT)

The TPT has been recently developed to take advantage of new, rapidly emplaceable, flexible storage tanks. The standard TPT uses 18 of these 5,000-barrel (210,000-gallon) collapsible tanks to provide fuel storage. When the TPT is deployed at its maximum size, it requires an area of about 160 acres. The tanks are interconnected, filled, and emptied by a system of flexible hoses and trailer-mounted pumps. The Petroleum Operating Battalion is responsible for emplacing fuel tanks, hoselines, and pumps.

Substantial engineer effort may be needed to help the petroleum operating battalion prepare the TPT site. The areas around the tank sites must be cleared of vegetation, and the sites must be leveled. Earth berms must be built to provide added support and horizontal protection for the tanks. The tank farm area must be properly drained to prevent water damage and to minimize problems from fuel spills or catastrophic failure of a tank. Interconnecting roads are needed within the tank farm, as well as access roads and parking areas for heavy vehicles at fuel dispensing points. A water supply for fire fighting may need to be developed.

BOLTED STEEL STORAGE TANKS

Bolted steel tanks with storage capacities of up to 10,000 barrels (420,000 gallons) are still in the supply system. These tanks are especially useful at petroleum terminals in places where area restrictions preclude the optimum spacing of collapsible tanks or where more permanent facilities are required. The erection of the bolted steel tanks requires considerably more time and engineer effort than collapsible tanks.

INLAND PETROLEUM DISTRIBUTION SYSTEMS (IPDS)

The IPDS is the system of pipelines, hoselines, and storage containers that extends from the shore or port as far forward toward the combat area as practical. The system consists of one or more main or trunk pipelines, pumping stations that move the product through the line, intermediate tank farms, branch lines to large users such as airfields, and the head terminal at the end of the line. The main pipeline may bean existing civilian pipeline provided by the HN, a line captured from the enemy, or a tactical military pipeline constructed by military engineers, or a combination. The construction materials used in tactical military pipelines are easily assembled and readily adaptable to existing conditions.

MILITARY IPDS PIPE AND COUPLINGS

The new standard pipe used in the military IPDS system is either a 6- or 8-inch nominal diameter aluminum pipe. The pipe comes in standard lengths of 20 feet. The pipe ends have special grooves rolled on the ends to allow sections of pipe to be joined with a gasket and coupling. The new couplings for the pipe are designed to be closed with a lever. The new pipe is considerably lighter than the older steel pipe and tubing, and can be joined

much faster and with fewer people. Aluminum pipe comes with curved elbow sections which allow pipe to negotiate turns and elbows. The aluminum pipe can be cut and the ends prepared in the field with special tools held by the Engineer Pipeline Construction Support Company.

PUMPS AND PUMP STATIONS

Pump stations are located along the pipeline to maintain the pressure required to move liquid fuel. Pump stations are operated by crews from the Petroleum Operating Battalion. These crews operate pumps, maintain equipment, and may perform pipeline patrol between adjacent pump stations. The spacing of the pump stations will depend upon the hydraulic design of the pipeline, as determined by the engineer, and the anticipated future requirements of the system, as determined by the petroleum group. On relatively flat terrain, pump stations will be about 15 to 20 miles apart. In mountainous terrain, pump stations may be much closer together.

Pump stations consist of a set of pumps, station fuel storage tanks, various pipeline operating equipment, and personnel facilities for the crews. The tactical and logistical situation will dictate the other features of the station. The pump station should be located on relatively high ground to allow fuel vapors to move away from the facility. Personnel facilities should be located away from the operating equipment because of noise and the presence of noxious fumes.

Assembling pump station components requires the specialized skills of personnel from the Engineer Pipeline Construction Support Company. Newly introduced equipment significantly reduces construction time, because many of the components are modularized. However, some fabrication is still required.

PIPELINE CONSTRUCTION AND MAINTENANCE

PLANNING PHASE

The engineer planning phase for the construction of a petroleum pipeline begins as soon as the need for a pipeline has been established. The ENCOM, in conjunction with the Petroleum Group and the Transportation Group, determines the general route for the pipeline. This ensures that the material required can be available when needed. In some cases, pipe has to be manufactured and shipped to the area. This may add months to the construction schedule.

Early determination of required construction units and support must be made. Transportation needs must be planned, since Engineer battalions have a limited lift capability to move themselves. The requirement to transport large volumes of pipeline material could prevent the rapid installation of the pipeline.

Final selection of the pipeline route begins after a physical reconnaissance of the areas to be crossed. The pipeline route will have these major characteristics:

- Route follows secondary roads in order to reduce disruption of traffic on the MSRs.
- Route should be the most level ground available and avoid sharp changes in elevation. Pipeline supports and suspension bridges allow the construction of the line over small and large gaps, but add to the construction time and amount of additional construction material required.
- Route avoids heavily populated areas to minimize potential problems from spills and to reduce opportunities for tampering.

- Route can service large users such as airfields.
- Route follows natural linear features such as wood edges and fence rows as an aid in camouflage.

It is essential to determine elevations along the route as part of the reconnaissance. These data are critical to the system's hydraulic design. The hydraulic design determines the location and number of pump stations and of certain control devices needed so the pipeline can work properly.

CONSTRUCTION PHASE

Different parts of the pipeline system can be built simultaneously. As construction crews are clearing the pipeline route, other crews can be building gap-crossing structures or installing pump stations and intermediate storage facilities. Thus, the construction of a pipeline system requires a maximum of flexibility and decentralized control of the construction elements. Leaders of small units must be well prepared to function with a minimum of supervision, because the construction battalion will likely have elements spread over many miles. In this way, the entire battalion can be effectively employed.

Tactical situation, terrain difficulty, and required supporting construction will determine how the construction will be carried out. The joining of pipeline elements is likely to be a short end phase, with longer earlier phases in which the battalion works in a decentralized fashion.

As the pipeline is assembled, certain sections will have to be tested carefully to make sure they are absolutely leak-proof. Any section of pipe that cannot be visually inspected or is not readily accessible must meet this criterion. Sections of pipe that are buried underground or are submerged under water must be tested. Other critical sections include any parts of a pipeline that are placed in tunnels used by personnel or vehicles. Leaks in tunnels may allow vapors to accumulate or expose the pipe to damage from moving vehicles. A fire or explosion may result.

The pipeline is best checked by pressure-testing with water. The engineer unit must provide water for this event. Water is introduced into the pipeline and subjected to increasing pressure for a period of time. The pipeline must maintain the required pressure for the specified period before the section of pipeline can be accepted by the operating unit. Testing with air can be used for shorter sections of line, but leaks are difficult to pinpoint. Under extreme operational requirements the testing may be authorized using fuel, but only as a last resort.

PIPELINE MAINTENANCE

Once the pipeline has been accepted by the petroleum operating battalion, that unit is responsible for maintenance. The unit will make frequent inspections of the line for visual signs of leaks and damage. The unit is capable of repairing minor leaks and replacing short sections of pipeline that have been damaged. However, the operating unit will need engineer support to make repairs beyond its capability, for instance, on buried pipe or pipe that is in an inaccessible location.

Safety is extremely important when dealing with pipeline breaks and leaks. Spilled fuel must be contained to reduce the fire hazard and to prevent contamination of water supplies. Absolute control of all flame- or spark-generating equipment or material within or near the work is vital.